Evolution of the Eastern Ghats Belt, India: A Magmatic Perspective – K. Vijaya Kumar, School of Earth Sciences, SRTM University, Nanded – 431 606 (E: vijay_kumar92@hotmail.com), C. Leelanandam, House No. 12-13-205/1, Street No. 2, Tarnaka, Hyderabad - 500 017 and W.G. Ernst, Department of Geological and Environmental Sciences, Stanford University, Stanford, California 94305-2215, USA

Mobile belts are garlands of high-grade metamorphic rocks encircling the stable cratonic nuclei. The mobile belts, in general, are composed of granulite facies meta-igneous and meta-sedimentary rocks when compared to the green schist to amphibolite facies rocks in the juxtaposed cratons. This observation was made by Fermor (1936) with respect to Indian subcontinent. Fermor (1936) designated this craton-mobile belt contact as “charnockite line” which separates Dharwar, Bastar and Singhbhum cratons and the Eastern Ghats Mobile Belt in the Southeastern part of India, and separates the Dharwar craton and Southern Granulite Terrain in Southern part of India. Singhbhum mobile belt, Satpura mobile belt and Delhi-Aravalli mobile belt along with Eastern Ghats mobile belt constitute the “Great Indian Proterozoic Fold Belt (GIPFOB)”. The mobile belts are variably interpreted as uplifted and deeply eroded cratonic margins as well as accreted allochthonous terrains to the cratons. In the latter case the contact between the craton and mobile belt constitutes a “suture”. A challenge for the geoscientists is to decipher the “truth” behind this conundrum of autochthonous or allochthonous origin of mobile belt terrains. In the present synthesis, we argue in favour of accreted origin for the Eastern Ghats Belt based field, petrographic, geochemical and U-Pb zircon isotopic evidences.

The Eastern Ghats Belt (EGB) is a polymetamorphosed, multideformed, deeply eroded granulite belt exposed along the SE Indian coast (Fig.1). It comprises granulite-facies metapelitic and metapsammitic gneisses (khondalites and associated quartzofeldspathic and calcareous granulites), mafic and felsic granulites (probably derived from igneous protoliths), massif-type anorthosites, alkaline rocks, S-type granites and a unique ultramafic-mafic layered complex at Kondapalli.

Different segments of the EGB had distinct styles and different spatio-temporal scales of evolution. Based on the structural history and marked isotopic signatures of the lithotectonic units, the EGB is divided into four crustal provinces with distinct evolutionary histories, viz., the Archaean Jeypore and Rengali Provinces, the Palaeo- and Meso-Proterozoic Krishna Province, and the Meso-Neo-Proterozoic Eastern Ghats Province; see Fig.1.

The present study focuses on the evolution of the Krishna Province occurring in the southern segment of the EGB. Three distinct tectono-magmatic rock units record Paleo- and Meso-Proterozoic events in Krishna Province. The Kondapalli Layered Complex (KLC) and the Kandra Ophiolite Complex (KOC) represent the Palaeoproterozoic magmatic arc + back-arc products, and the alkaline rocks + variegated dykes represent the Mesoproterozoic rift-related magmatism. Major tectonothermal events produced lithologic assemblages attending high to ultrahigh-T metamorphism of the protoliths at ~1.60 Ga and ~1.0 Ga.

Palaeoproterozoic crustal growth along the SE margin of India involved ocean closure, arc accretion, and final continent-continent collision. This continuum from accretion of island arcs through conti-

nental arc formation to terminal continental collision generated and refined the Palaeoproterozoic crust along the SE margin of India. The Kondapalli A-type granites record the first extensional event along the eastern margin of the subcontinent between 1890 and 1850 Ma. These rifted continental margins and oceanic basins were closed by arc-continent and final continent-continent collision at 1.6 Ga. Subduction-related magmatism including the suprasubduction-zone ophiolite along the SE margin of India represents vital evidence from Gondwana for the Palaeoproterozoic cycle of continental amalgamation.

A second cycle of extension, initiated between 1.5 and 1.35 Ga, involved the intrusion of nepheline syenites (*i.e.*, Alkaline Rocks and Carbonatites, ARCs) + variegated mafic dykes and the concomitant development of large sedimentary basins. This rifting produced an outboard transitional to true oceanic crust paralleling the Palaeoproterozoic arc axis. These nepheline syenites evidently formed within a rift on thickened continental crust. Their subsequent deformation, producing Deformed Alkaline Rocks and Carbonatites (DARCs), was caused by continental collision between the EGB and

Fig.1. (a) Diagrammatic representation of the Great Indian Proterozoic Fold Belt (GIPFOB; modified after Radhakrishna and Naqvi, 1986) with four distinct mobile/fold belt components. EGB = Eastern Ghats Belt; SFB = Singhbhum Fold Belt; CITZ = Central Indian Tectonic Zone; ADFB = Aravalli-Delhi Fold Belt. (b) Schematic illustration of the craton-mobile belt contact (X-Y transect across the EGB). (c) Generalized geological map of the EGB with four distinct crustal provinces (modified after Dobmeier and Raith, 2003).

juxtaposed cratons. The highly deformed, metamorphosed nepheline syenites straddling the western margin of the EGB represent two important segments of the Wilson cycle. A line of DARCs represents both a rifted continental margin and a suture marking the site of ocean closure. The Palaeo- and Meso-Proterozoic tectonothermal events in the Eastern Ghats Belt are correlated with supercontinent formation and fragmentation cycles on a global scale.